

FM Radio Circuit

TDA7020T

GENERAL DESCRIPTION

The TDA7020T integrated circuit is for FM portable radios, stereo as well as mono, where a minimum periphery is important in terms of small dimensions and low cost. The IC has a FLL (Frequency Locked Loop) system with an intermediate frequency of 76 kHz. The selectivity is obtained by active RC filters. The only function to be tuned is the resonant circuit of the oscillator. Interstation-noise as well as noise from receiving weak signals is reduced by a correlation mute system.

Special precautions have been taken to meet local oscillator radiation requirements. Because of the low intermediate frequency, low pass filtering of the MPX signal is required to avoid noise when receiving stereo. 50 kHz roll-off compensation, needed because of the low pass characteristic of the FLL, is performed by the integrated LF amplifier. For mono application this amplifier can be used to directly drive an earphone. The field-strength detector enables field-strength dependent channel separation control.

The TDA7020T includes the following functions:

- RF input stage
- Mixer
- Local oscillator
- IF amplifier/limiter
- Frequency detector
- Mute circuit
- Loop amplifier
- Internal reference circuit
- LF amplifier for:
 - mono earphone amplifier or
 - MPX filter
- field-strength dependent channel separation control facility

QUICK REFERENCE DATA

Supply voltage range (pin 4)	V_P		1,8 to 6 V
Supply current at $V_P = 3$ V	I_P	typ.	6,3 mA
RF input frequency range	f_{rf}		1,5 to 110 MHz
Sensitivity for -3 dB limiting (e.m.f. voltage) (source impedance: 75 Ω ; mute disabled)	EMF	typ.	3 μ V
Signal handling (e.m.f. voltage) (source impedance: 75 Ω)	EMF	typ.	200 mV
AF output voltage	V_O	typ.	90 mV

PACKAGE OUTLINE

16-lead mini-pack; plastic (SO-16; SOT-109A).

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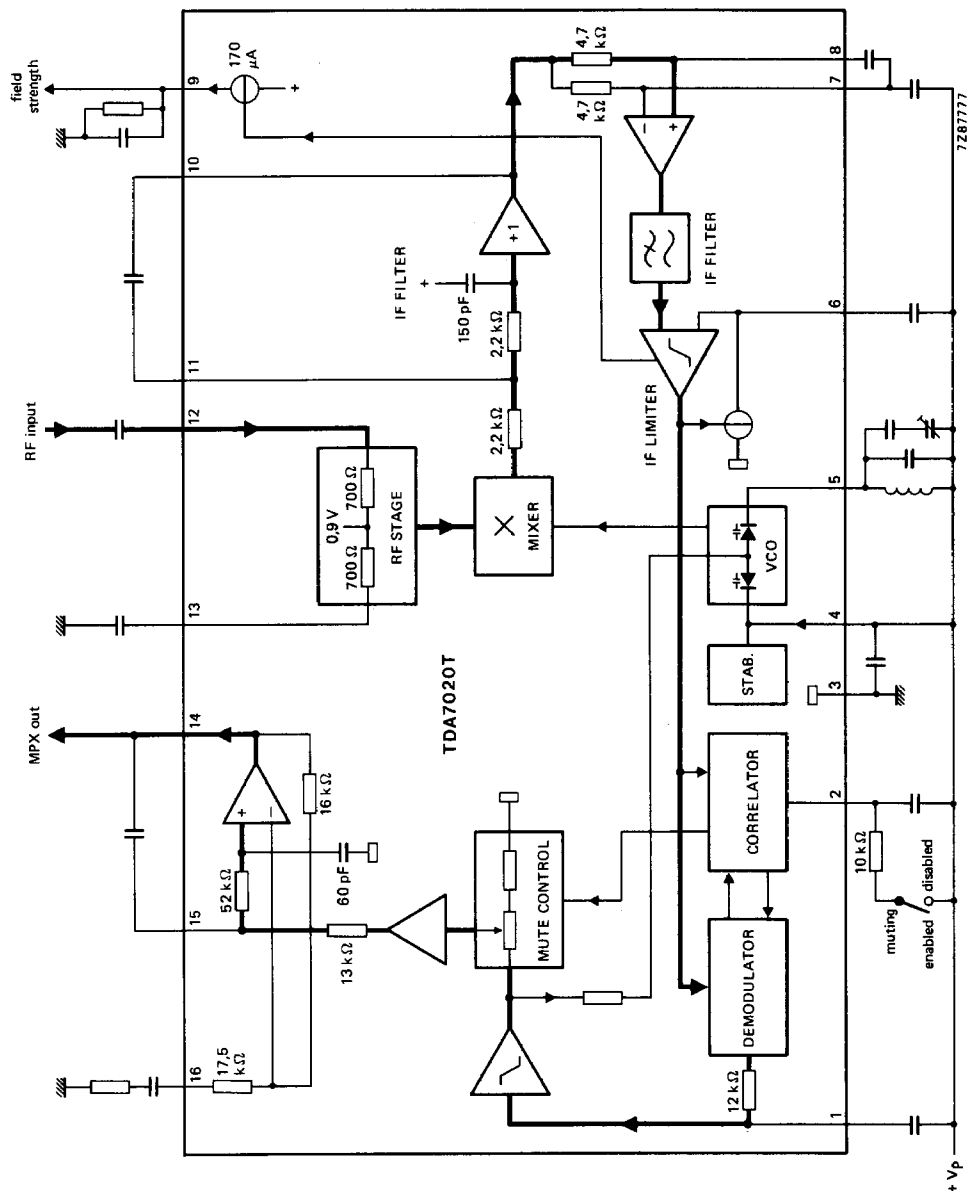


Fig. 1 Block diagram.

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RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 4)	V_P	max.	7 V
Oscillator voltage (pin 5)	V_{6-5}	$V_P - 0,5$ to $V_P + 0,5$	V
Total power dissipation	see derating curve (Fig. 2)		
Storage temperature range	T_{stg}	-55 to + 150	°C
Operating ambient temperature range	T_{amb}	-10 to + 70	°C

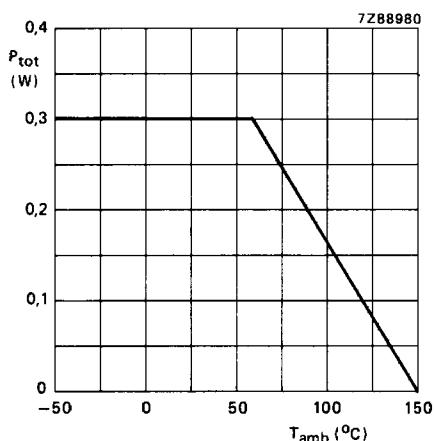


Fig. 2 Power derating curve.

D.C. CHARACTERISTICS

 $V_P = 3$ V; $T_{amb} = 25$ °C; measured in Fig. 4; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply voltage (pin 4)	V_{4-3}	1,8	3,0	6	V
Supply current at $V_P = 3$ V	$-I_3$	—	6,3	—	mA
Oscillator current (pin 5)	I_5	—	250	—	μA
Voltage at pin 13	V_{13-3}	—	0,9	—	V
Output voltage (pin 14)	V_{14-3}	—	1,3	—	V

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A.C. CHARACTERISTICS MONO

$V_P = 3\text{ V}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$; measured in Fig. 4; $f_{rf} = 96\text{ MHz}$ modulated with $\Delta f = \pm 22,5\text{ kHz}$; $f_m = 1\text{ kHz}$; $EMF = 300\text{ }\mu\text{V}$ (e.m.f. voltage at a source impedance of $75\text{ }\Omega$); r.m.s. noise voltage measured unweighted ($f = 300\text{ Hz}$ to 20 kHz); unless otherwise specified.

parameter	symbol	min.	typ.	max.	unit
Sensitivity (see Fig. 3) (e.m.f. voltage)					
for -3 dB limiting; muting disabled	EMF	—	4,0	—	μV
for -3 dB muting	EMF	—	5,0	—	μV
for $S/N = 26\text{ dB}$	EMF	—	6,5	—	μV
Signal handling (e.m.f. voltage) for $THD < 10\%$; $\Delta f = \pm 75\text{ kHz}$	EMF	—	200	—	mV
Signal-to-noise ratio	S/N	—	60	—	dB
Total harmonic distortion at $\Delta f = \pm 22,5\text{ kHz}$	THD	—	0,7	—	%
at $\Delta f = \pm 75\text{ kHz}$	THD	—	2,3	—	%
AM suppression of output voltage (ratio of AM signal: $f_m = 1\text{ kHz}$; $m = 80\%$ to FM signal: $f_m = 1\text{ kHz}$; $\Delta f = \pm 75\text{ kHz}$)	AMS	—	45	—	dB
Ripple rejection ($\Delta V_P = 100\text{ mV}$; $f = 1\text{ kHz}$)	RR	—	30	—	dB
Oscillator voltage (pin 5) r.m.s. value	$V_{5-3}(\text{rms})$	—	250	—	mV
Variation of oscillator frequency with supply voltage ($\Delta V_P = 1\text{ V}$)	$\Delta f_{osc}/\Delta V_P$	—	5	—	kHz/V
with temperature	$\Delta f_{osc}/\Delta T$	—	0,2	—	kHz/K
Selectivity	S_{+300}	—	30	—	dB
	S_{-300}	—	46	—	dB
AFC range	$\pm \Delta f_{rf}$	—	160	—	kHz
Mute range	$\pm \Delta f_{rf}$	—	120	—	kHz
Audio bandwidth at $\Delta V_O = 3\text{ dB}$ measured with pre-emphasis ($t = 50\text{ }\mu\text{s}$)	B	—	10	—	kHz
AF output voltage (r.m.s. value) at $R_L(\text{pin } 14) = 100\text{ }\Omega$; pin 16 open	$V_O(\text{rms})$	—	90	—	mV
AF output current max. d.c. load	$I_O(\text{dc})$	—100	—	+100	μA
max. a.c. load for $THD = 10\%$	$I_O(\text{ac})$	—3	—	+3	mA

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parameter	symbol	min.	typ.	max.	unit
Field strength signal					
EMF = 5 μ V	-lg	—	160	—	μ A
EMF = 50 μ V	-lg	—	100	—	μ A
EMF = 500 μ V	-lg	—	30	—	μ A

A.C. CHARACTERISTICS

For **STEREO** operation (only the difference to MONO is given)

$V_p = 3$ V; $T_{amb} = 25$ °C; measured in Fig. 5; $f_{rf} = 96$ MHz modulated with pilot $\Delta f = \pm 6,75$ kHz and AF signal $\Delta f = \pm 22,5$ kHz; $f_m = 1$ kHz; EMF = 1 mV (e.m.f. voltage at a source impedance of 75 Ω); r.m.s. noise voltage measured unweighted ($f = 300$ Hz to 20 kHz); unless otherwise specified.

parameter	symbol	min.	typ.	max.	unit
Sensitivity (Fig. 3) (e.m.f. voltage) for S/N = 46 dB	EMF	—	300	—	μ V
Signal-to-noise ratio	S/N	—	53	—	dB
Channel separation	α	—	20	—	dB
Pilot voltage level at pin 14	V_{pilot}	—	12	—	mV
Selectivity	S_{+300}	—	22	—	dB
	S_{-300}	—	40	—	dB

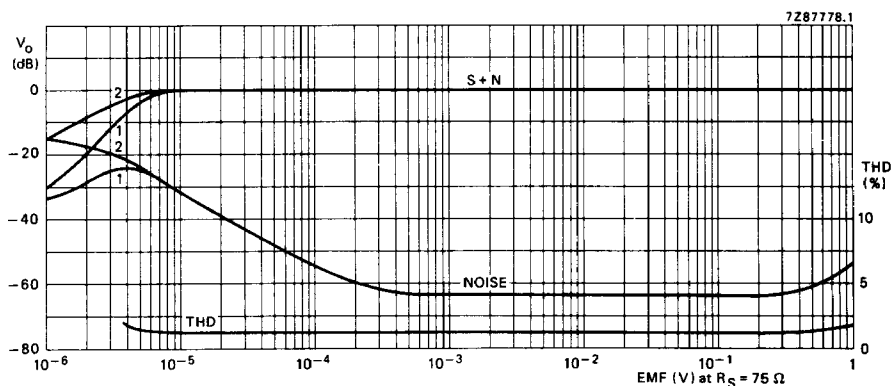


Fig. 3 A.F. output voltage (V_o) and total harmonic distortion (THD) as a function of the e.m.f. input voltage (EMF) with a source impedance (R_s) of 75 Ω : (1) muting system enabled; (2) muting system disabled.

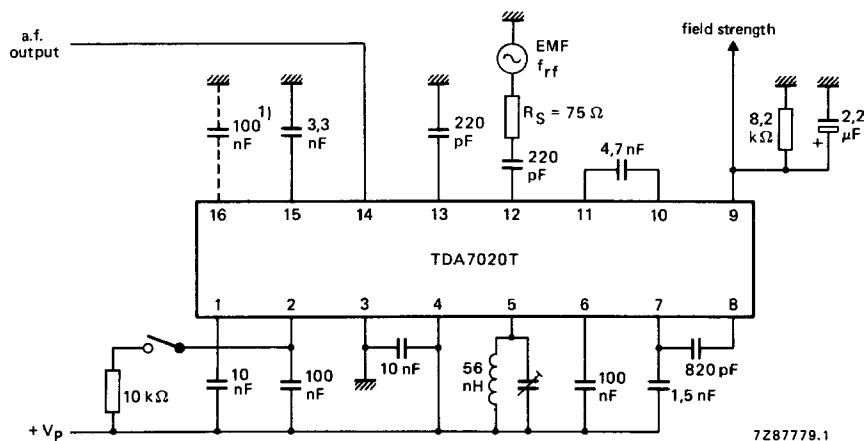
Conditions: 0 dB = 100 mV; $f_{rf} = 96$ MHz.
 for S + N curve: $\Delta f = \pm 22,5$ kHz; $f_m = 1$ kHz.
 for THD curve: $\Delta f = \pm 75$ kHz; $f_m = 1$ kHz.

Note

The muting system can be disabled by feeding a current of about 20 μ A into pin 2.

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- 1) To facilitate the use of high-impedance earphones the AF output can be increased by 5 dB by connection of the 100 nF capacitor to pin 16.

Fig. 4 Test circuit for MONO operation.

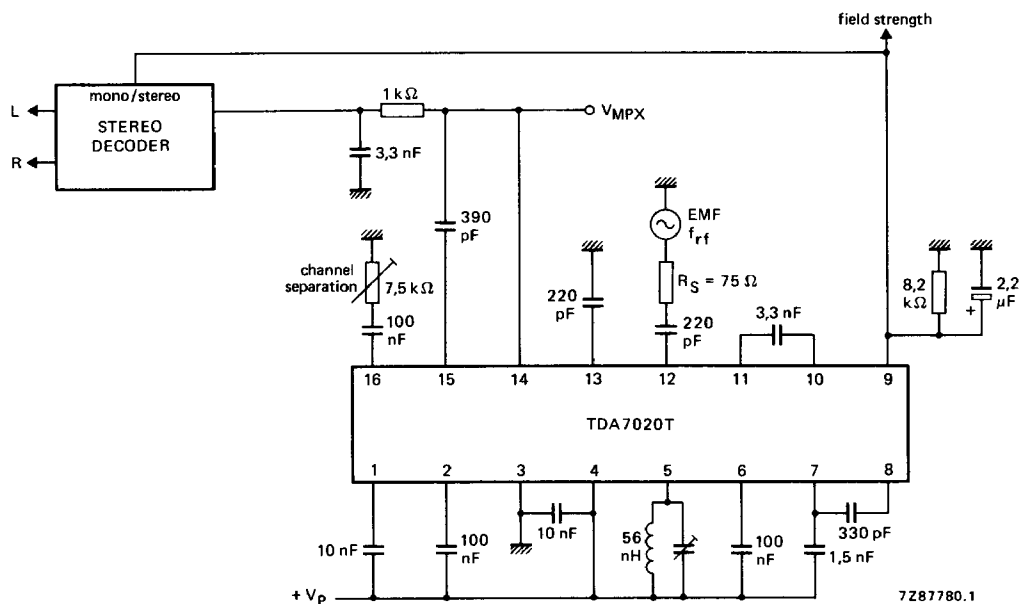


Fig. 5 Test circuit for STEREO operation.